Three world summits on nuclear security have focused attention on securing the world’s most dangerous nuclear material, particularly materials considered ‘direct-use’ for nuclear weapons. In lead up to the fourth and last summit, source materials such as processed uranium ore concentrates should also be considered.

Since the first nuclear security summit of 2010, the emphasis has been on reducing and securing the most sensitive nuclear material such as highly enriched uranium or separated plutonium. Source materials such as uranium ore concentrates (UOC) have generally not factored into the discussion given

**RECOMMENDATIONS**

- An effective national nuclear security regime addressing risks associated with UOC includes physical protection measures, inventory controls, transport security measures and emergency response which reflect:

- A risk-based approach to address security risks to persons, property, society and the environment associated with the unauthorised removal and sabotage of UOC.

- A graded approach to apply increasing security measures to protect UOC as it is concentrated, purified, stored and transported.
A symbiotic approach to providing threat based information should pass from the regulatory body to the operator

Specific additional security measures are needed as the attractiveness and vulnerability of the material increases with UOC that is precipitated, concentrated, purified and transported.

these materials have to go through a number of sophisticated steps such as conversion, enrichment, reconversion and assembly before producing material suitable for use in a nuclear weapon. However, natural uranium is the source material for both a civilian nuclear energy programme and nuclear weapons. Practical security measures against the unauthorised removal or misuse of UOC provides additional opportunities for detection, thereby strengthening a state’s nuclear security programme across the entire nuclear fuel cycle.

The risk

Uranium contained in ore and in the majority of the milling, extraction and concentration process is low risk and is usually (and effectively) protected using current industry best practice. The biggest barrier to illicitly removing ore is to do so without detection, given that the quantities are so large. Even assuming high-grade uranium at the site, it is extremely unlikely that such an operation involving anywhere from 10 to 100 dump trucks’ worth of material could be transported without being noticed. Nonetheless, this has not stopped attempts to steal ore, as witnessed in Brazil in 2004 when police seized 1,320 pounds of ore in a pick-up truck close to the Caetité mine; or in Namibia when 324 kg of uranium ore was stolen from the not-yet operational Trekkopje Mine in August 2011.

Uranium becomes more attractive to adversaries as it becomes further processed and potentially more vulnerable when it reaches concentrated form or is further precipitated/purified, stored and transported. Given that UOC falls outside of full scope safeguards implemented by the International Atomic Energy Agency (IAEA), there is a risk of diversion or unauthorised removal of UOC from the mine/mill or during storage and transport by outsiders, insiders or a combination of the two. In September 2009, the insider/outside risk was demonstrated when two employees of the Rössing Uranium Mine in Namibia and a member of the Namibian Defence Forces were arrested trying to sell 170 kg of UOC to an undercover police agent. While the operation at Rössing was initiated by the Namibian police and raised the question of whether such operations catch smugglers or create them, the risk of such a scenario increases if inventory, accountancy management and tracking procedures are poor and the facility is located in a state that has limited regulatory oversight.

Moreover, while the radiological consequences of UOC sabotage are low, UOC is a high-value commodity, and therefore industrial sabotage may be a risk many operators take into account, particularly in heightened security environments. AREVA, for example, treats UOC as a high-value target in Niger which requires assistance from the government to guard the mine and escort the UOC convoy. Despite these security measures, coordinated car bombings thirty minutes and 250 km apart at the military barracks in Agadez and Areva’s Somair uranium mine in May 2013, killed one mine employee, injured fourteen others and partially shut down the mine for over two months. Full operations did not resume until early August 2013. The suspension cost an estimated US $36.8 million a month. Uranium sabotage therefore comes with its own risk given its high value within the nuclear supply chain. To address sabotage and unauthorised removal, prudent management practice at the front-end of the nuclear fuel cycle includes a risk-based, graded approach to nuclear security.

A risk-based approach

The employment of threat, risk and vulnerability assessments identifies the level of protection required
and forms the basis for implementing security measures. These assessments should include the potential threats to UOC in use, storage and transport, as well as associated sensitive information for both insider and outsider threats. The risks associated with each threat are estimated with reference to the likelihood of the threat occurring. Vulnerabilities and measures to mitigate them are then identified. A symbiotic approach to providing threat-based information should pass from the regulatory body to the operator so it can design and implement its security system.

Threat, risk and vulnerability assessments should be updated regularly to reflect any changes to threat levels and their accompanying implications for physical protection measures. Establishing and regularly reviewing security requirements should include a system of evaluation, licensing and enforcement. With assessments in hand, a graded approach can be applied that takes into account current (and ongoing) evaluations of threat and the potential consequences should uranium be lost from custody.

A graded approach
As noted above, uranium contained within the majority of the extraction and concentration process can be adequately protected using common industrial security practices. Specific additional security measures are needed as the attractiveness and vulnerability of the material increases with UOC that is precipitated, concentrated, purified and transported. A graded approach applies these measures based on threat assessments and consequences resulting from unauthorised removal and sabotage. Minimum security measures may be in place at all times, with additional measures added (or removed) as changes in risks and threat levels require.

The scope of a state’s physical protection regime will depend on the stages of the nuclear fuel cycle present in-country, i.e. whether the state is a uranium producer, consumer, transit state or a combination of...
all three. Measures to address the risk of unauthorised removal and sabotage will also depend on the threats and risks assessed nationally (by the State) and industrially (by the operator). These measures typically include a combination of physical protection and inventory control measures which may or may not already be reflected in various safety standards. Physical protection includes detection, delay and response measures. Inventory controls include technical and administrative controls such as process monitoring, item counting and ledgers capable of tracking and tracing each drum or container from the time they are filled or loaded until UOC is fed into the conversion process.

A graded approach should also consider that, for safeguards purposes, the IAEA has determined the timeliness goal for detection of a significant quantity of natural uranium (ten tonnes or approximately 35 drums of UOC) is one year. However, the detection of the unauthorised removal of a quantity of UOC equivalent to a single drum over a one-month period is considered prudent for nuclear security purposes. Security measures therefore should seek to achieve a stronger detection goal.

In developing and implementing a risk-based, graded approach to ‘uranium security’, both states and operators can look to the IAEA and its forthcoming (in early 2016) guidance entitled ‘Nuclear Security in the Uranium Industry.’ This guidance adopts a comprehensive approach to nuclear security. It recognises that an effective national nuclear security regime builds on the implementation of relevant international legal instruments; information protection; physical protection; material accounting and control; detection of and response to trafficking in such material; and national response plans and contingency measures.